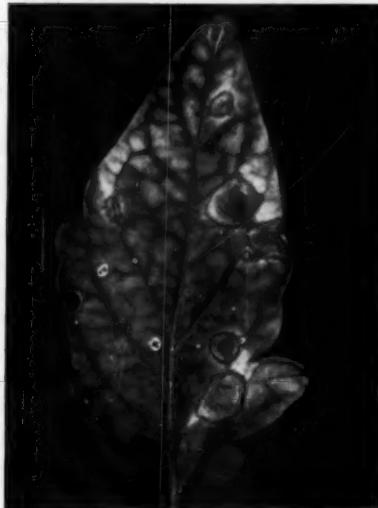


Identification and Control of Tomato Diseases in the Home Garden

BY ARDEN F. SHERF



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In New York State, tomatoes are attacked by a number of diseases, each of which can be controlled if correctly identified and treated. Satisfactory control involves more than spraying or dusting. Good growers know that long rotations, proper varieties, and weed control also are important. On the following pages, specific symptoms of tomato diseases are described, and measures for their control are listed.

EARLY BLIGHT

Early blight, caused by the fungus *Alternaria solani*, is the most common tomato disease in New York State home gardens. It is primarily a foliage blight but also may cause a fruit rot around the stem end of the fruit in the late fall. Early blight is characterized by brown irregular spots with concentric rings in a target pattern on the lower leaves. These spots soon enlarge to $\frac{1}{4}$ - or $\frac{1}{2}$ -inch in diameter, run together, cause the leaf to turn brown, and usually to drop off. Robbing the plant of its leaves decreases the size of fruits and exposes them to sunscald. If weather conditions are favorable, this blight will move up the plant until all leaves on the lower half drop off. Spotting and girdling of the stems also may take place.

The early blight fungus overwinters in old tomato debris in the ground and on weeds such as Jimson, horsenettle, ground cherry and nightshade. Seeds or transplants also may carry the fungus. Regular applications of fungicides give the best control (see page 4).

ANTHRACNOSE

Anthracnose is a fungus disease that primarily affects the ripe fruit and causes a slight sunken spot rot. The earliest symptoms are circular sunken spots in the skin, which look as though they had been made with a match head or eraser. On ripe fruit, these spots enlarge rapidly and the central portion may appear dark from black fungus structures just under the skin. Soon the entire fruit rots as other organisms enter and break down the tissues. Sunken, circular, dime-sized spots with black specks in them are typical of this disease. When August temperatures are high and heavy rains or dews occur, watch for anthracnose. The fungus overwinters not only in diseased vines but also on and in the

seeds. Long rotations and hot water seed treatment (122°F. for 25 minutes) are very helpful for control. Regular fungicide applications, beginning weeks before symptoms appear, are very helpful, too (see page 4).

LATE BLIGHT

Late blight can be devastating on fruit, stems, and leaves when weather conditions are favorable (long periods of muggy weather with cool nights and moderately warm days). This fungus disease produces greasy black areas on the leaf margins, which soon consume the entire leaf. A fine grey mold can be seen on the underside of the leaf during wet periods. Both green and ripe fruits become corky brown on their surfaces and have a texture resembling an orange peel. The rot remains firm but makes the fruit non-edible.

Late blight originates either in infected transplants or blows into the garden from blighted potatoes in the vicinity. Fortunately, this blight occurs only one in 10 to 12 years. A strict spray program will control it (see page 4).

Control of Fungus Diseases

To produce high yields of disease-free tomatoes, regular applications of a chemical such as maneb (Manzate, Dithane M22), Dyrene, or zineb must be made. Maneb is first choice. When evenly distributed over the leaves, stems, and fruits in sprays or dusts, these fungicides prevent the germination and entrance of fungus spores into these plant parts. To be most effective, the chemical must be present during the rainy warm periods most favorable for fungus infection. Proper timing of applications is very important and should begin *when fruits of the first cluster are first visible* after blossom drop. Additional applications must be made every seven to ten days throughout the season. These chemicals are harmless at recommended rates and can be used through the entire picking season.

Although sprays generally give better coverage and better control, dusts, if carefully used, may be satisfactory. Dusts may be easier to apply, but are more expensive than sprays. Either should be applied when little wind is present; dusts should be applied on damp foliage in early morning or late evening. Two tablespoonfuls of chemical per gallon of water covers about 100 feet of fully grown tomato plants. This is equal to about the $\frac{1}{2}$ pound of five to eight percent dust needed for a 100-foot row. Smaller amounts suffice on young plants.

One- to three-gallon compressed air sprayers, which can be carried on the shoulder, are handy and easy to use. For large acreages, use a small portable power sprayer. *Caution:* Do not use a sprayer that has been used previously for weed killers such as 2-4D. *Keep a separate sprayer for weed killers.* Bellows, plunger, or rotary type dusters can be used to apply the dust formulations.

Application Rates for Recommended Fungicides

Chemicals	Amount Used		Timing
	Per gallon of water	Per 100 feet of row	
SPRAYS			
Maneb	2 Tbsp.	1 gal.	Every 7-10 days
Dyrene	2 Tbsp.	1 gal.	Every 10 days
Zineb	2 Tbsp.	1 gal.	Every 7-10 days
DUSTS (5-8%)			
Zineb	—	½ lb.	Every 5 days
Maneb (only if freshly mixed)	—	½ lb.	Every 5 days
ALL PURPOSE MIX			
Various fungicides	Use as directed on label		Every 5 days

FUSARIUM WILT

Fusarium wilt occurs most often on Long Island, where only resistant tomato varieties should be planted. Wilt also occurs in improperly treated greenhouse soils but does not affect commercial fields upstate. The fusarium fungus can live in soil for many years, but causes infection only when soil temperatures reach 75°F. to 85°F. Fusarium causes a true wilt of the vascular or food and mineral transport system of the plant. First symptoms are yellowing of the lower older leaves on a single stem. These leaves soon die, and others follow until even the top portions are yellow and wilted. Infection occurs through the root hairs, goes into the vascular system and thereby reaches the plant extremities. A brown discolored streak will have formed about $\frac{1}{8}$ -inch under the bark of the main stem and usually extends to the top of the plant. Slice the stem near the soil line to locate this fairly positive diagnostic symptom.

Control of Fusarium Wilt

Because the fusarium fungus lives many years in the soil, rotation is of little value. The best control is the use of one of the following resistant varieties: Manalucie, Homestead, Indian River or Roma (pear type). Other resistant varieties include Kokomo, Brookston, Garden State, Sunray, W. R. Jubilee, Wiltmaster, Marion, 146, and Manapal. Other are forthcoming.

Walnut wilt, which often is confused with fusarium or Verticillium wilt, is a simple toxicity problem. It is caused when walnut tree roots reach under the tomatoes and give off a chemical that causes tomatoes to wilt.

VERTICILLIUM WILT

The fungus that causes Verticillium wilt is present in many soils of New York because it attacks many different crops. These include tomatoes, potatoes, peppers, eggplants, melons, strawberries, raspberries, and stone fruits.

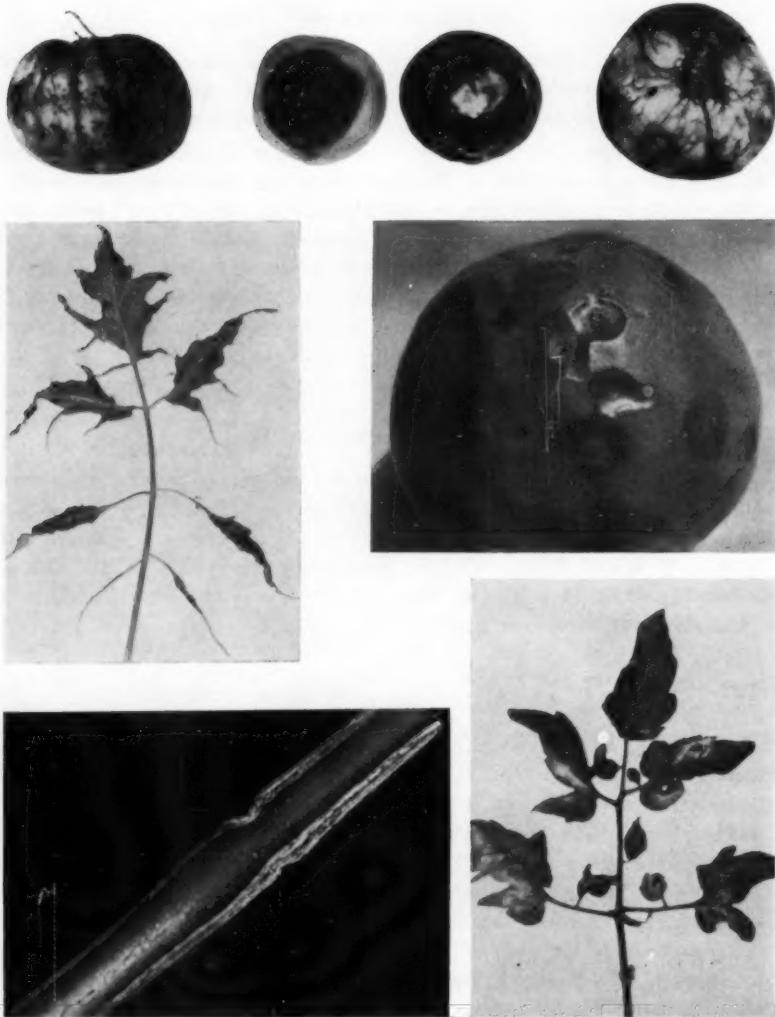
The chief symptom on tomatoes is the development of yellowish splotches on the older leaves in the center of the plant. Soon chocolate-brown spots develop in the middle of the yellow area, and the plants drop some of their lower leaves. Mid-day wilting and evening recovery is common. Careful inspection of a slit stem near the soil line will show tan streaks in the vascular system just inside the bark. This dead tissue prevents proper transport of food and minerals to and from the root system. The internal stem discoloration is most pronounced near the soil line, and seldom extends to the top of the plant.

Control of Verticillium Wilt

Because the fungus survives so long in the soil and because of its internal nature, it cannot be controlled by foliage fungicides. Two California varieties that are resistant to Verticillium wilt, but tend to be very late in maturing, are Pearson VF 6, and Pearson VF 11. Eastern varieties worthy of trial include Geneva 11 and Red Top V9 (the latter a pear type). Further work is underway to breed better resistant eastern types.

BLOSSOM-END ROT

Blossom-end rot is common in home gardens where tomato plants are set out early in cold soils and hoed closely. Large sunken black leathery areas near the blossom-end of the fruits characterize the disease. Secondary fungus organisms may inhabit these spots, but are not the cause of the disease. Blossom-end rot is a physiological disorder; it is not caused by a living organism. It results basically from failure of the plant to transport sufficient water to the cells of the developing fruit. When this happens, water is withdrawn from the cells in the blossom-end of the fruit, and these tissues die. Lack of calcium uptake from dry soils and poor transport of calcium to the fruits is thought to play a role in this disorder in Florida; however, calcium sprays have given no relief when used in New York tests. Dry weather produces the disease, especially if soils have had enough moisture to permit a rapid, succulent, early plant growth. Although a sudden lack of water is the main cause, excessive moisture in heavy soils may smother the root hairs and cause the rot to develop in sudden hot weather. Blossom-end rot may be more serious on the windward than on the leeward side of a field, and on staked plants than on prostrate or bushy ones.



Tomato disease symptoms: **top left**, double virus streak on tomato fruit; **top center**, blossom end rot on two fruits; **top right**, yellow strain of tobacco mosaic; **center right**, anthracnose on fruit; **bottom right**, Verticillium wilt on plant; **bottom left**, brown vascular system at edges of stem infected with Fusarium wilt; **center left**, cucumber mosaic on plant.

Control of Blossom-End Rot

Because blossom-end rot is so closely related to water supply, an important control is careful regulation of soil moisture. If irrigation is possible, it should be used to keep the soil moisture constant. The land should be well drained to allow good root development. Mulching, which helps maintain an even level of soil moisture, is an effective preventative. Straw or other mulching materials are practical and should be used in the home garden.

Hoeing or cultivating should be done no closer than one foot from the plants to avoid root pruning. Liberal amounts of fertilizer high in superphosphate should be used (4-12-4 or 5-20-5). Greenhouse transplants should be neither severely hardened nor too old. Tomatoes planted unusually early in cold soils are likely to develop this rot on their first fruits.

PHYSIOLOGIC LEAF ROLL

In wet spring periods, the older lowest leaves on tomato plants often roll upward. These leaves are firm and leathery to the touch, and give the plant a temporarily sickly appearance. As temperatures rise and soils dry out, these symptoms disappear and normal growth resumes. No damage is done to the fruits that develop later.

VIRUS DISEASES

Although seven or eight virus diseases are known to occur in eastern tomatoes, only three are of importance in New York home gardens. These are caused by the tobacco mosaic virus, the cucumber mosaic virus, and the combination streak viruses.

Viruses are tiny infectious protein substances that cannot be seen under ordinary microscopes. Their presence can be detected, however, if healthy plants become diseased after being rubbed with sap from a diseased plant. Viruses are long lived and are spread by contaminated hands or tools, or by insects.

Tobacco mosaic virus is the most common virus disease of tomatoes. It causes plant leaves to become mottled with yellow and green, and to develop a rough texture. These mottled areas may turn brown and die. Infected plants usually are stunted and bear few fruits, although the number of blossoms may be normal. Some fruits may be russeted and have streaks and deformities; others may only be small and have poor flavor. Because several strains of virus may be involved, a wide range of symptoms may be exhibited. The virus may be present in the transplants when set out, or it may be introduced into garden plants by insects. These insects get the virus from feeding first on weeds such as ground cherry, plantain, horseradish, Jimson weed, nightshade, catnip and Jerusalem cherry. Under average garden conditions, the seed or soil are not sources of infection.

Cucumber mosaic virus causes the formation of misshapen, shoestring type leaves similar to those from 2-4D injury. Infection of young plants causes severe stunting. Seldom does more than two percent of a planting become infected because this mosaic virus is not easily transmitted by hand, nor does it withstand drying out. Nearly all spread is by aphids that carry it from nearby weeds, flowers, and other vegetables. Because this virus lives in milkweed, catnip, motherwort, white cockle, burdock, wild cucumber, flowering spurge, horseradish, pokeweed, Jimson weed, phlox, marigold, petunia, zinnia and hollyhock, these should not be allowed near tomatoes. Cucumbers, melons and peppers also may be infected and serve as a source of virus.

Streak is a combination of several mosaic viruses. Dead areas form along the veins, in the leaves of plants, and brown streaks appear on the petioles and on the main stem. Light brown dry sunken spots that resemble speckling with tobacco juice form on the green fruits. Because various combinations of virus may be present, the symptoms offer a wide range of expression and severity. Fortunately streak seldom affects more than two percent of an outdoor garden or field.

Control of Virus Diseases

The most important measure for control of virus diseases is to eliminate weed hosts for at least 150 feet around the garden or greenhouse. In addition, no ornamentals or perennial flowers such as gladioli and geraniums should be grown near tomatoes. Because transmission of viruses is easy, avoid handling flowers or tobacco in any form before working with tomatoes. Finally, use a good insecticide early and regularly on tomatoes to prevent aphid feeding.

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